

## PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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## (54) AN AIR CONDITIONING AND DISTRIBUTION PLANT

(71) We, SPOLAR ENGINEERING SYSTEMS AG, a Swiss Body Corporate of Zug, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an air conditioning and distribution plant for distributing conditioned air to a plurality of working zones. The invention is particularly useful in the textile industry for spinning and other types of machines. The plant may also be used in the printing industry for machines with heat emission and for working zones requiring a predetermined moisture content.

Various systems are known for air-conditioning machines of the type referred to or for air conditioning the rooms in which such machines are installed. In one system used in the textile industry, a mixture of outside and inside air is filtered, heated and moistened in an air-conditioning plant. The mixture of air prepared by this plant is then blown in an oversaturated state into the room. For introducing the conditioned air into the working zone, channels equipped with grids and blowing nozzles are used. By using this system the moisture content of the whole room is influenced. In order to obtain the required conditions of the air for the individual machines it is necessary to provide additional apparatus. The relatively high air temperatures and moisture contents are unpleasant for the operators. In some cases disturbances of the physical condition of the operators are observed.

In another known system each machine has its own air-conditioning plant comprising air suction means, filter, heater, washer (moistening means), blower and air distributor means. Each plant is provided with hand or automatically operable air flow controlling flaps. Depending on the desired moisture content the heater may not be mounted. This system provides only a very slow change of the state or condition of the air. It is also very difficult to obtain a satisfactory and precise

control of the desired state or condition of the air. If more than one machine is connected to a single plant, it is impossible to obtain individual air conditioning for each machine.

With conventional air-conditioning plants, the air in the whole room must be brought into the required state for the working zone. The volume of air to be fed and the cost for the installation are therefore very high.

The present invention seeks to provide an improved air-conditioning and distribution plant, avoiding at least partially the known disadvantages without loss of efficiency.

In accordance with the present invention there is provided an air-conditioning and distribution plant for distributing conditioned air to a plurality of working zones situated within a common room, said plant comprising a central conditioning station for producing conditioned air, said station having a first inlet for outside air and a second inlet for air from the common room, a plurality of air distribution ducts for installation in respective working zones, means for distributing the conditioned air from the central station to respective first inlets provided in respective distribution ducts, each said duct being provided with a second inlet through which, during use, air is drawn from the working zone and is mixed with the conditioned air from the central station and with means for individually varying the quantity of air entering the duct through said first inlet, conveying means for drawing air through said central conditioning station, means acting on said conveying means for controlling the quantity of air being conditioned in dependence on the individual settings of said varying means, and output means in said ducts for feeding the air mixtures to the working zones.

This air-conditioning plant enables the mass flow, the temperature and the relative moisture content of the air in all zones equipped with distributor ducts to be individually controlled.

In order that the invention may be better understood some embodiments thereof will now be described by way of example only

and with reference to the accompanying drawings in which:—

Figure 1 is a diagrammatic view of an air conditioning and distribution plant constructed in accordance with the present invention and

Figures 2, 3 and 4 illustrate diagrammatically three different arrangements of the distributor ducts in the working zones.

The air-conditioning and distribution plant shown in Figure 1 comprises a central conditioning station for preparing so-called primary air. This station comprises the following components:

a) an inlet 1 for outside or fresh air provided with a device 2 for controlling the quantity of air entering the station. This may be, for example, flaps of aluminium or other non-corrosive material.

b) an inlet 3 for room air together with an associated device 4 for controlling the flow of the air (e.g. also flaps) enabling, for example, air from the conditioned working zones to be recirculated.

Both said inlet channels for outside and room air 1 and 3 respectively lead to a common channel 5 for primary air.

In this primary air channel 5 are mounted the following:

c) a filter 6 for cleaning the primary air stream.

d) a heater for heating, if required, the primary air. This heater may e.g. work with hot water.

e) a cooler 8, e.g., in the form of a heat exchanger supplied with cold water, for cooling, if required or necessary, the primary air.

f) an air washer 9 serving also as an air moistening device, comprising a circulating pump 10, spray tubes 11 and a collecting tank 12. A washing or moistening device working with vapor may be used.

g) a reheater 13 (not absolutely necessary) for reheating, if required or necessary, the primary air. Such reheater may have the same construction as the heater described under d) hereinbefore.

h) a conveyor 14, e.g. an axial or tangential blower, together with a governor or control unit 15.

i) a silencer 17 for damping the noise in the working zones. The outlet of the primary air channel 5, i.e. the outlet of the central conditioning station for primary air, is connected to a collecting channel or manifold A for conditioned primary air. A plurality of air distributor ducts 18, 18', 18'' etc. arranged one or more in each of the different working zones C, C', C'' etc. to be conditioned, are connected to the manifold A by means of connecting channels B, B', B'' etc.,

i.e. to the central conditioning station 1 to 17.

The distributor ducts 18, 18', 18'' etc. may be arranged above, below or on the side of the machines in the zones C, C', C'' etc. to be conditioned (see Figures 2, 3 and 4). The air is discharged from the ducts 18, 18', 18'' etc. through outlet openings provided in the duct side walls, e.g. through circular or slit nozzles 22 having an adjustable outlet section. The ducts 18 may be of circular or other cross section. The plant may be of the high, or low pressure type. It is possible to connect any number of machines or zones to the central conditioning station, depending on the power or output thereof.

Each connecting channel B is provided with a throttling device 19. The quantity of air delivered by the central station is controlled automatically by maintaining constant pressure in the manifold A. The pressure in the manifold A is maintained constant by varying the output (i.e. the speed of rotation) of the air conveyor 14 or by varying the blade angle of the impeller of the conveyor 14. For controlling or operating the governor 15 an electric, hydraulic or pneumatic or an electronic system is used, for example the piezometer 16.

Each connecting channel B terminates within corresponding distributor channel 18 in a nozzle 20.

Primary air flow from each nozzle 20 induces a flow of secondary air S from the working zones into the respective distributor duct 18, 18', 18'' etc. through apertures formed in that part of the ducts 18, 18', 18'' etc. adjacent the nozzle 20. The secondary air S is mixed with the primary air P discharged through nozzle 20 in the distributor duct. Throttle devices 21 are provided in order to individually control the supply of secondary air S into the ducts. Thus, the desired mass flow and condition of air may be individually controlled for each of said distributor ducts.

The mixture of primary air P and secondary air S forms the air mass serving to condition the working zones C. As stated hereafter, a heat exchanger (heater or cooler) may also be provided in the secondary air circuit.

As the conditioned primary air has normally a lower temperature than the air taken from the working zones and as it has usually a higher moisture content, the variation of the mixing proportion of primary and secondary air allows different states or conditions of the output air-mixture to be obtained.

Each distributor duct 18 may be provided with a meter for measuring air flow, temperature and humidity.

In order to obtain a precise control of the condition of the air a heat exchanger may be provided to act upon the primary air flow P, secondary air flow S or mixed

air flow, together with all necessary measuring and control devices.

If desired, moistening and filtering means may be provided to act upon at least one of the primary or secondary air flows.

#### WHAT WE CLAIM IS:—

1. An air conditioning and distribution plant for distributing conditioned air to a plurality of working zones situated within a common room, said plant comprising a central conditioning station for producing conditioned air, said station having a first inlet for outside air and a second inlet for air from the common room, a plurality of air distribution ducts for installation in respective working zones, means for distributing the conditioned air from the central station to respective first inlets provided in respective distribution ducts, each said duct being provided with a second inlet through which, during use, air is drawn from the working zone and is mixed with the conditioned air from the central station and with means for individually varying the quantity of air entering the duct through said first inlet, conveying means for drawing air through said central conditioning station, means acting on said conveying means for controlling the quantity of air being conditioned in dependence on the individual settings of said varying means, and output means in said ducts for feeding the air mixtures to the working zones.

2. An air conditioning and distribution plant as claimed in claim 1 wherein, during use, the distribution ducts are mounted near a source of heat.

3. An air conditioning and distribution plant as claimed in claim 1 or 2 wherein, in each duct, the first inlet comprises a nozzle extending inwardly of the duct at a position adjacent said second inlet to the duct.

4. An air conditioning and distribution plant as claimed in claim 1, 2 or 3, wherein

a plurality of air distribution ducts are installed in each working zone.

5. An air conditioning and distribution plant as claimed in any of the preceding claims wherein said output means in said ducts comprises a plurality of nozzles provided in a peripheral side wall of each of said distribution ducts.

6. An air conditioning and distribution plant as claimed in any of the preceding claims wherein said controlling means includes a piezometer.

7. An air conditioning and distribution plant as claimed in any of the preceding claim wherein heat exchanging means are provided in the path of said conditioned air.

8. An air conditioning and distribution plant as claimed in any of the preceding claims wherein moistening and filtering means are provided in the path of said conditioned air.

9. An air conditioning and distribution plant as claimed in any of the preceding claims, wherein means are provided for heating or cooling the air drawn from said working zones into the second inlets of said distribution ducts.

10. An air conditioning and distribution plant as claimed in any of the preceding claims wherein means are provided for moistening and filtering the air drawn from said working zones into the second inlets of said distribution ducts.

11. An air conditioning and distribution plant for distributing conditioned air to a plurality of working zones, substantially as hereinbefore described with reference to the accompanying drawings.

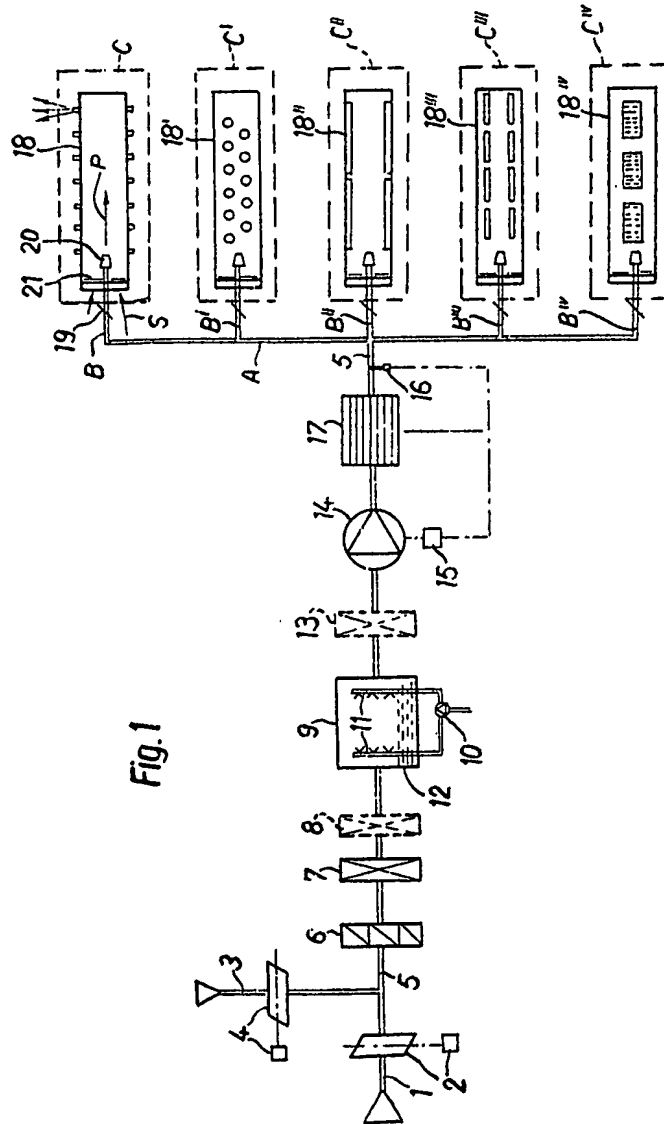
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